## **SEQUENCE LISTING**

SEQ ID NO:1 - FVO-PCR1;

5'-GGGTCGGTACCATGGCAGTAACTCCTTCCGTAATTGAT-3'

SEQ ID NO:2 - FVO-PCR2;

5'-GGATCAGATGCGGCCGCTTAACTGCAGAAAATACCATCGAAAAGTGGA-3'

SEQ ID NO:3 - EA3;

5'-TAAAAAATATATAAACGACAAAC-3'

SEQ ID NO:4 - EA5;

5'-AAAAGGGAAGATATTTCTCATTT-3'

SEQ ID NO:5 - EA485-CDFVO,

5'- CGCAGTTACTCCATCTGTTATTGATAATATTCTTTCTAAAATTGAAAA CGAATATGAGGTTTTATATTTAA-3'

SEQ ID NO:6 - EA493-CDFVO,

**Table 1.** Harmonization of *P. falciparum* MSP1-42 for expression in *E. coli* using *P. falciparum* and *E.coli* codon harmonization data

Residue	AA	Native Codon	Relat. Codon Usage	Harmonized codon	Relat. Codon Usage
		(P. falciparum)	(% dev from mean)	(E coli cl. 2)	(% dev from mean)
1	Α	GCA	71	GCT	10
2	V	GTA	65	GTT	59
3	Т	ACT	4	ACG	-50
4	Р	CCT	59	CCA	-39
5	S	TCC	-52	TCG	-56
6	V	GTA	65	GTT	59
7	1	ATT	18	ATT	2
8	D	GAT	73	GAC	8
9	N	AAC	<b>-</b> 72	AAT	-65 400
10	l	ATA	65	ATC	100
11	L	СТТ	-32	CTC	-50
12	S	TCT	39	AGC	46
13	K	AAA	63	AAA	57
14	1	ATT	18	ATT	2
15	Е	GAA	71	GAA	51
16	N	AAT	72	AAC	65
17	Ε	GAA	71	GAA	51
18	Υ	TAT	78	TAC	30
19	Е	GAG	-71	GAG	-51 50
20	V	GTT	61	GTT	59
21	L	TTA	276	CTG	359
22	Υ	TAT	78	TAC	30
23	L	TTA	276	CTG	359 57
24	K	AAA	63	AAA	57
25	Р	CCT	59	CCA	-39
26	L	TTA	276	CTG	359 10
27	Α	GCA	71	GCT	71
28	G	GGT	67	GGC	59
29	٧	GTT	61	GTT	30
30	Y	TAT	78	TAC CGT	285
31	R	AGA	263	TCT	94
32	S	AGT	91	CTG	359
33	L	TTA	276	AAA	57
34	K	AAA	63	AAA	57
35	K	AAA	63		63
36	Q	CAA	74	CAG CTG	359
37	L	TTA	276	GAA	51
38	E	GAA	71 72	AAC	65
39	N	AAT	-72	AAT	-65
40	N	AAC	-72 61	GTT	-03 59
41	V	GTT	0	ATG	0
42	M	ATG	112	ACC	114
43	T	ACA	67	TTC	42
44	F	TTT	07	110	72

45	N	AAT	72	AAC	65
46	V	GTT	61	GTT	59
47	N	AAT	72	AAC	65
48	V	GTT	61	GTT	59
49	K	AAG	-63	AAG	-57
50	D	GAT	73	GAC	8
51	1	ATT	18	ATT	2
52	L	TTA	276	CTG	359
53	N	AAT	72	AAC	65
54	S	TCA	56	AGC	46
55	R	CGA	-46	CGC	98
56	F	TTT	67	TTC	42
57	N	AAT	72	AAC	65
58	K	AAA	63	AAA	57
59	R	CGT	-32	CGC	98
60	Ε	GAA	71	GAA	51
61	N	AAT	72	AAC	65
62	F	TTC	-67	TTC	-42
63	K	AAA	63	AAA	57
64	N	AAT	72	AAC	65
65	V	GTT	61	GTT	59
66	L	TTA	276	CTG	359
67	Ε	GAA	71	GAA	51
68	S	TCA	56	AGC	46
69	D	GAT	73	GAC	8
70	L	TTA	276	CTG	359
77	1	ATT	18	ATT	2
72	Р	CCA	83	CCA	-39
73	Υ	TAT	78	TAC	30
74	K	AAA	63	AAA	57
75	D	GAT	73	GAC	8
76	L	TTA	276	CTG	359
77	T	ACA	112	ACC	114
78	S	TCA	56	AGC	46
79	S	AGT	91	TCT	94
80	N	AAT	72	AAC	65 80
81	Υ	TAT	78	TAC	30
82	V	GTT	61	GTT	59
83	V	GTC	-75	GTC	-46
84	K	AAA	63	AAA	57
85	D	GAT	73	GAC	8 -39
86	Р	CCA	83	CCA	30
87	Y	TAT	78	TAC	57
88	K	AAA	63	AAA	42
89	F	TTT	67	TTC CTC	-50
90	L	CTT	-32		-50 65
91	N	AAT	72	AAC	57
92	K	AAA	63	AAA	57 51
93	E	GAA	71	GAA	57
94	K	AAA	63	AAA	285
95	R	AGA	263	CGT	8
96	D	GAT	73	GAC	O

97	K	AAA	63	AAA	57
98	F	TTC	-67	TTC	-42
99	L	TTA	276	CTG	359
100	S	AGC	-63	TCG	-56
101	S	AGT	91	TCT	94
102	Y	TAT	78	TAC	30
103	N	AAT	72	AAC	65
104	Y	TAT	78	TAC	30
105	İ	ATT	18	ATT	2
106	К	AAG	-63	AAG	-57
107	D	GAT	73	GAC	8
108	S	TCA	56	AGC	46
109	1	ATA	65	ATC	100
110	D	GAT	73	GAC	8
111	Т	ACG	-63	ACG	-50
112	D	GAT	73	GAC	8
113	1	ATA	65	ATC	100
114	N	AAT	72	AAC	65
115	F	TTT	67	TTC	42
116	Α	GCA	71	GCT	10
117	N	AAT	72	AAC	65
118	D	GAT	73	GAC	8
119	V	GTT	61	GTT	59
120	L	CTT	-32	CTC	-50
121	G	GGA	107	GGC	71
122	Υ	TAT	78	TAC	30
123	Υ	TAT	78	TAC	30
124	K	AAA	63	AAA	57
125	1	ATA	65	ATC	100
126	L	TTA	276	CTG	359
127	S	TCC	-52	TCG	-56
128	Ε	GAG	-71	GAG	-51
129	K	AAA	63	AAA	57
130	Υ	TAT	78	TAC	30
131	K	AAA	63	AAA	57
132	S	TCA	56	AGC	46
133	D	GAT	73	GAC	8
134	L	TTA	276	CTG	359
135	D	GAT	73	GAC	8
136	S	TCA	56	AGC	46 2
137	ı	ATT	18	ATT	57
138	K	AAA	63	AAA	57
139	K	AAA	63	AAA	30
140	Υ	TAT	78	TAC	100
141	I	ATA	65	ATC	-65
142	N	AAC	-72 -70	AAT	-03 -8
143	D	GAC	-73	GAT	-6 57
144	K	AAA	63	AAA	63
145	Q	CAA	74 67	CAG GGC	71
146	G	GGT	67 71	GAA	51
147	E	GAA	71 72	AAC	65
148	N	AAT	72	AAC	00

149	Ε	GAG	-71	GAG	-51
150	ĸ	AAA	63	AAA	57
151	Υ	TAC	-78	TAT	-30
152	Ĺ	CTT	-32	CTC	-50
153	Р	CCC	-60	CCT	-55
154	F	TTT	67	TTC	42
155	L	TTA	276	CTG	359
156	N	AAC	-72	AAT	-65
157	N	AAT	72	AAC	65
158	1	ATT	18	ATT	2
159	E	GAG	-71	GAG	-51
160	T	ACC	-53	ACG	-50
161	L	TTA	276	CTG	359
162	Y	TAT	78	TAC	30
163	K	AAA	63	AAA	57
164	Т	ACA	112	ACC	114
165	V	GTT	61	GTT	59
166	N	AAT	72	AAC	65
167	D	GAT	73	GAC	8
168	ĸ	AAA	63	AAA	57
169	ï	ATT	18	ATT	2
170	D	GAT	73	GAC	8
171	Ĺ	TTA	276	CTG	359
172	F	TTT	67	TTC	42
173	v	GTA	65	GTT	59
174	i	ATT	18	ATT	2
175	H	CAT	71	CAC	40
176	L	TTA	276	CTG	359
177	Ē	GAA	71	GAA	51
178	Ā	GCA	71	GCT	<sup>*</sup> 10
179	K	AAA	63	AAA	57
180	V	GTT	61	GTT	59
181	L	CTA	-52	CTC	-50
182	N	AAT	72	AAC	65
183	Υ	TAT	78	TAC	30
184	Т	ACA	112	ACC	114
185	Υ	TAT	78	TAC	30
186	E	GAG	-71	GAG	-51
187	K	AAA	63	AAA	57
188	S	TCA	56	AGC	46
189	N	AAC	-72	AAT	-65
190	V	GTA	65	GTT	59
191	Ε	GAA	71	GAA	51
192	V	GTT	61	GTT	59
193	K	AAA	63	AAA	57
194	i	ATA	65	ATC	100
195	K	AAA	63	AAA	57
196	Ε	GAA	71	GAA	51
197	L	CTT	-32	CTC	-50
198	N	AAT	72	AAC	65
199	Υ	TAC	-78	TAT	-30
200	L	TTA	276	CTG	359

201	K	AAA	63	AAA	57
202	Т	ACA	112	ACC	114
203	1	ATT	18	ATT	2
204	Q	CAA	74	CAG	63
205	D	GAC	-73	GAT	-8
206	K	AAA	63	AAA	57
207	L	TTG	-18	CTC	-50
208	Ā	GCA	71	GCT	10
209	D	GAT	73	GAC	8
210	F	TTT	67	TTC	42
211	K	AAA	63	AAA	57
212	ĸ	AAA	63	AAA	57
213	N	AAT	72	AAC	65
214	N	AAC	-72	AAT	-65
215	N	AAT	72	AAC	65
216	F	TTC	-67	TTC	-42
217	V	GTT	61	GTT	59
218	Ğ	GGA	107	GGC	71
219	ı	ATT	18	ATT	2
220	A	GCT	67	GCT	10
221	D	GAT	73	GAC	8
222	L	TTA	276	CTG	359
223	S	TCA	56	AGC	46
224	T	ACA	112	ACC	114
225	D	GAT	73	GAC	8
226	Y	TAT	78	TAC	30
227	, N	AAC	-72	AAT	-65
228	Н	CAT	71	CAC	40
229	N	AAT	72	AAC	65
230	N	AAC	-72	AAT	-65
231	L	TTA	276	CTG	359
232	L	TTG	-18	CTC	-50
233	T	ACA	112	ACC	114
234	ĸ	AAG	-63	AAG	-57
235	F	TTC	-67	ттс	-42
236	Ĺ	стт	-32	стс	-50
237	S	AGT	91	TCT	94
238	T	ACA	112	ACC	114
239	Ġ	GGT	67	GGC	71
240	М	ATG	0	ATG	0
241	V	GTT	61	GTT	59
242	F	TTT	67	ттс	42
243	E	GAA	71	GAA	51
244	N	AAT	72	AAC	65
245	Ĺ	стс	-86	СТС	-50
246	A	GCT	67	GCT	10
247	ĸ	AAA	63	AAA	57
248	T	ACC	-53	ACG	-50
249	v	GTT	61	GTT	59
250	L L	TTA	276	CTG	359
251	S	тст	39	AGC	46
252	N	AAT	72	AAC	65
232	1.4	771	, _	, , , , ,	

253	L	TTA	276	CTG	359
254	L	CTT	-32	CTC	-50
255	D	GAT	73	GAC	8
256	G	GGA	107	GGC	71
257	N	AAC	-72	AAT	-65
258	L	TTG	-18	СТС	-50
259	Q	CAA	74	CAG	63
260	Ğ	GGT	67	GGC	71
261	M	ATG	0	ATG	0
262	L	TTA	276	CTG	359
263	N	AAC	-72	AAT	-65
264	ī	ATT	18	ATT	2
265	S	TCA	56	AGC	46
266	Q	CAA	74	CAG	63
267	H	CAC	-71	CAT	-40
268	Q	CAA	74	CAG	63
269	č	TGC	-75	TGT	-22
270	V	GTA	65	GTT	59
271	K	AAA	63	AAA	57
272	K	AAA	63	AAA	57
273	Q	CAA	74	CAG	63
274	Ĉ	TGT	. · 75	TGC	22
275	P	CCA	83	CCA	-39
276	Q	CAA	74	CAG	63
277	N	AAT	72	AAC	65
278	S	TCT	39	AGC	46
279	G	GGA	107	GGC	71
280	Ċ	TGT	75	TGC	22
281	F	TTC	-67	TTC	-42
282	R	AGA	263	CGT	285
283	Н	CAT	71	CAC	40
284	L	TTA	276	CTG	359
285	D	GAT	73	GAC	8
286	E	GAA	71	GAA	51
287	R	AGA	263	CGT	285
288	Е	GAA	71	GAA	51
289	E	GAA	71	GAA	51
290	С	TGT	75	TGC	22
291	K	AAA	63	AAA	57
292	С	TGT	75	TGC	22
293	L	TTA	276	CTG	359
294	L	TTA	276	CTG	359
295	N	AAT	72	AAC	65
296	Υ	TAC	-78	TAT	-30
297	K	AAA	63	AAA	57
298	Q	CAA	74	CAG	63
299	Ε	GAA	71	GAA	51
300	G	GGT	67	GGC	71
301	D	GAT	73	GAC	8
302	K	AAA	63	AAA	57
303	С	TGT	75	TGC	22
304	V	GTT	61	GTT	59

305	Ε	GAA	71	GAA	51
306	N	AAT	72	AAC	65
307	Р	CCA	83	CCA	-39
308	N	AAT	72	AAC	65
309	Р	CCT	59	CCA	-39
310	Т	ACT	4	ACG	-50
311	С	TGT	75	TGC	22
312	N	AAC	-72	AAT	-65
313	E	GAA	71	GAA	51
314	N	AAT	72	AAC	65
315	N	AAT	72	AAC	65
316	G	GGT	67	GGC	71
317	Ğ	GGA	107	GGC	71
318	Ċ	TGT	75	TGC	22
319	D	GAT	73	GAC	8
320	Ā	GCA	71	GCT	10
321	D	GAT	73	GAC	8
322	A	GCC	-58	GCC	-36
323	ĸ	AAA	63	AAA	-50 57
324	C	TGT	75	TGC	22
325	T	ACC	-53	ACG	-50
326	Ē	GAA	71	GAA	-50 51
327	E	GAA	71	GAA	51
328	D	GAT	73	GAC	8
329	S	TCA	73 56		
330	G	GGT	67	AGC GGC	46 71
331	S	AGC	-63	TCG	71 56
332	N	AAC	-03 -72		-56
333	G	GGA	107	AAT GGC	-65
334	ĸ	AAG	-63	AAG	71 57
335	K	AAA	63		-57
336	I	ATC		AAA	57 40
337	Ť	ACA	-80	ATT	19
338	Ċ	TGT	112	ACC TGC	114
339	E	GAA	75 71		22
340	C		71 75	GAA	51
341	T	TGT	75 4	TGC	22
342	K	ACT AAA		ACG	-50
343	P	CCT	63 59	AAA	57
344	D			CCA	-39
344 345	S	GAT TCT	73	GAC AGC	8
345 346	Y	TAT	39 70		46
340 347	P	CCA	78	TAC	30
34 <i>1</i> 348			83	CCA	-39
349	L F	CTT	-32	CTC	-50
		TTC	-67 72	TTC	-42
350 351	D G	GAT GGT	73 67	GAC	8
351 352			67	GGC	71
352 353	l F	ATT TTC	18 67	ATT	2
353 354	C	TGC	-67 -75	TTC	-42 22
35 <del>4</del> 355	s	AGT	-75 91	TGT	-22 72
60051812 v1	3	AGI	ופ	AGT	-73